Montana Department of
ENVIRONMENTAL QUALITY

Attachment A:

Demonstration of Substantial and Widespread Economic Impacts to Montana That Would Result if Base Numeric Nutrient Standards had to be Met in 2011/2012

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.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS

Acronym	Definition
BOD	Biochemical Oxygen Demand
CDBG	Community Development Block Grant
CEIC	Census and Economic Information Center
CFR	Code of Federal Regulations
DEQ	Department of Environmental Quality (Montana)
EPA	Environmental Protection Agency (US)
HUD	U.S. Housing and Urban Development
LMI	Low and Moderate Income rate
MFI	Montana's median family income
MHI	Median Household Income
MPS	Municipal Preliminary Screener
RO	Reverse Osmosis
SF	Summary File
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
WERF	Water Environment Research Foundation
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

An analysis was undertaken to determine the degree and extent of economic impact that would occur in Montana as a result of publically owned wastewater treatment plants (WWTPs) having to comply to meet the base numeric nutrient standards. DEQ used technical data from engineers and published papers, U.S. census and demographic data, DEQ staff, EPA staff, and data from Montana WWTP operators to carry out the analysis. The analysis shows that affected communities across Montana would bear substantial and widespread economic impacts (i.e., economic hardship) if they had to meet base numeric nutrient standards today.

The treatment technology used to simulate costs to WWTPs consisted of advanced mechanical treatment combined with reverse osmosis. Treatment costs included those associated with nitrification/denitrification and biological phosphorus removal, high rate clarification, and denitrification Filtration. Costs were estimated from the DRAFT Interim WERF study "*Finding the Balance Between Wastewater Treatment Nutrient Removal and Sustainability, Considering Capital and Operating Costs, Energy, Air and Water Quality and More*" (WERF, 2011).

A sample of 24 affected WWTPs was used to estimate costs of having to meet Montana's base nutrient criteria. EPA's Economic Guidance (EPA, 1995) was used to determine whether affected WWTPs in Montana would be adversely affected economically by having to meet nutrient criteria. The three main tests from the guidance were used in this analysis and include the municipal preliminary screener, the Secondary score, and the Widespread test.

Out of the 24 town sample, 21 towns would experience a wastewater bill greater than 2% median household income in order to meet base nutrient criteria. When a sensitivity analysis is run, 23 out of 24 towns would experience a bill greater than 2% MHI. The one town that would not, Missoula, already meets nutrient criteria on the Clark Fork. After calculating the secondary scores for each of the 24 towns, all 24 would experience a 'Significant' impact using the "significance matrix" found in EPA guidance.

The widespread impact part of the test is open ended, and looks at the ripple effects from the significant impacts. A widespread impact is estimated to occur in almost all Montana town due to a more than doubling of the average wastewater bill (bills increase by 100% to 700% in the sample), a lower than average median household income for Montana, the current recession, and diminishing populations/narrow economies in most Montana towns. In additional, finding qualified WWTP operators for most Montana towns would be a challenge, as well as finding deep injection wells for the brine from reverse osmosis.

BACKGROUND

The Montana Department of Environmental Quality (DEQ) began developing numeric nutrient standards for state surface waters in 2001. A field pilot study was undertaken from 2001-2003 to identify and refine approaches for developing the criteria in the plains region of the state. Work from 2003-2008 focused on the selection of an appropriate zoning system by which the criteria would be applied, collection of data from reference streams to help with criteria derivation, and identification of harm-to-use thresholds for uses that nutrients affect. During this same period DEQ undertook a focused data collection to support the QUAL2K water-quality model which was then used to develop numeric nutrient criteria for a large river (lower Yellowstone). In addition, DEQ collected data to support lake nutrient standards (this work in ongoing, as are other field projects intended to further refine the flowing water criteria).

In 2008, DEQ released draft nutrient criteria for wadeable streams (Suplee et al. 2008) and presented these to stakeholders. DEQ has subsequently refined the process by which wadeable stream criteria are derived, and is in the process of preparing those as of this writing; draft values are shown below (**Table 1**) along with draft criteria for the lower Yellowstone River. In **Table 1** and throughout this analysis, the N stands for nitrogen and the P for phosphorus. While stakeholders understand that the criteria were derived based on sound science and reflect values that are protective of the designated uses, the proposed criteria are stringent (**Table 1**). As a result, the stakeholder community has been concerned about what their permit limits will be as well as the opportunities for variances. Many WWTPs discharging into wadeable streams do not have instream dilution and would be required to meet the nutrient criteria end-of-pipe. For the lower Yellowstone River, the proposed criteria are above (i.e., have a higher concentration than) the ambient river concentrations during the seasonal low flow period. This situation means that WWTPs discharging directly to the Yellowstone may not need to meet the criteria at the end-of-pipe, although that has yet to be determined.

Table 1. Montana Draft Nutrient Criteria

Level III Ecoregion	Period When Criteria Apply	Parameter		
		Total P (mg/L)	Total N (mg/L)	Benthic Algae Criteria
Northern Rockies	July 1 -Sept. 30	0.025	0.3	120 mg Chl *a*/m^2 (36 g AFDW/m^2)
Canadian Rockies	July 1 -Sept. 30	0.025	0.3	120 mg Chl *a*/m^2 (36 g AFDW/m^2)
Middle Rockies	July 1 -Sept. 30	0.030	0.3	120 mg Chl *a*/m^2 (36 g AFDW/m^2)
Idaho Batholith	July 1 -Sept. 30	0.030	0.3	120 mg Chl *a*/m^2 (36 g AFDW/m^2)
Northwestern Glaciated Plains	June 16-Sept. 30	0.12	1.1	n/a
Northwestern Great Plains, Wyoming Basin	July 1 -Sept. 30	0.12	1.0	n/a
Yellowstone River (Bighorn R. confluence to Powder R. confluence)	Aug 1 -Oct 31	0.09	0.70	Nutrient concentrations based on limiting pH impacts
Yellowstone River (Powder R. confluence to stateline)	Aug 1 -Oct 31	0.14	1.0	Nutrient concentrations based on limiting nuisance algal growth

Suplee, M., V. Waterson, A. Varghese, and J. Cleland. 2008. Scientific and Technical Basis of the Numeric Nutrient Criteria for Montana's Wadeable Streams and Rivers. Montana Department of Environmental Quality.

Due to the difficulty of currently meeting the draft nutrient criteria, Senate Bill 367 was signed by Governor Schweitzer on April 21, 2011.

SB 367 authorizes individual, general and alternative variances. Under the general variance limits established in SB 367, permit limits would be established at 1 mg/l TP and 10 mg/l TN for facilities discharging $\geq$ 1 MGD or 2 mg/l TP and 15 mg/l TN for facilities discharging $\leq$ 1 MGD. Lagoons would be capped at their current nutrient load.

The purpose of this paper was to quantify the costs of meeting the base numeric nutrients standards (**Table 1**) today, given the current state of treatment technology and the current economic status of the state. This paper demonstrates the substantial and widespread economic and social impact of nutrient criteria to the 107 affected public WWTPs in Montana. This document provides DEQ's demonstration supporting the statute language that all dischargers are, at the present time, exempt from meeting the base nutrient standards based on "Substantial and Widespread" economic impacts. Impacts to private dischargers will be demonstrated in a separate paper.

THE STUDY

MONTANA'S WWTPS

Out of the total number of WWTPs in Montana, which number about 200, 107 were identified as ones that would be affected by the nutrient criteria. WWTPs on Indian Reservations were not included as they are not regulated by the state (they have EPA permits). Also, a large number of WWTPs do not empty into a state surface water because either they land apply (spray irrigation), discharge to groundwater or landlocked lakes, are total containment systems, or are those for which these criteria would not apply (e.g., those that discharge to large rivers for which there is not yet a model/criteria). Thus, about half of Montana WWTPs would not have to meet these criteria, and most of these are smaller systems. The 107 WWTPs that would have to meet the criteria affect about 50% of Montana's population. The other 50% of Montana citizens are hooked up to one of the other 100 or so WWTPs not affected, or are on a septic system (generally more rurally based). These numbers are for residential hook-ups and do not include small and large businesses, schools or government.

Existing wastewater fees in affected Montana towns average about 0.9% of each town's median household income (MHI) across the state (based on a sample of 48 towns), with larger towns paying as little as 0.43% MHI and smaller towns paying up to 1.68% MHI (**Figure 1**). There is no clear correlation between town size and current wastewater fees, with the exception that the seven large towns over 19,000 in population are generally paying a lower MHI due to a larger population to spread out costs. Different towns pay different rates due to the age and effectiveness of the current system, past grant monies, current level of technology, size and quality of receiving stream, groundwater infiltration, and incoming wastewater quality. Most towns currently pay less than 1.5% MHI, with the majority of those paying less than 1.0% of MHI for wastewater treatment.

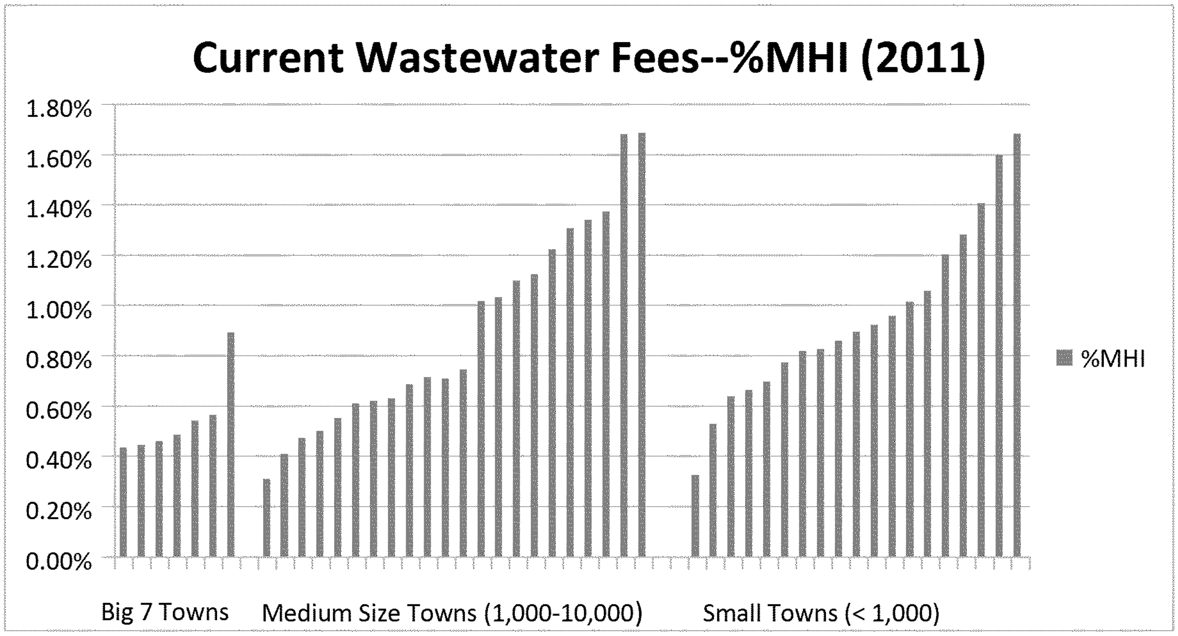

Figure 1- Current Annual Wastewater Costs as a Percentage of MHI in Montana Communities[1]

Summary of DEQ's Three-Step Process for Determining Substantial and Widespread Impacts

EPA regulations allow a variance from a water quality standard if the pollutant controls "…would result in substantial and widespread economic and social impact" (40 CFR 131.10(g)(6)). For public entities (e.g. WWTPs), EPA's 1995 guidance (EPA 1995) suggests a three-step process to determine substantial economic impacts, and an additional analysis to determine widespread impacts. Although the guidance is typically used to evaluate individual WWTPs, DEQ followed the guidance in this demonstration to determine whether affected WWTPs in Montana as a whole would face economic hardship from base numeric nutrient criteria. This was done as a result of the impracticality of running an individual economic test on all 107 affected WWTPs.

Following the guidance, the first of two major "tests" in the Substantial determination (the first step) is to demonstrate that meeting the numeric nutrient criteria today would cost more than 2% of a community's Median Household Income (MHI) for most or all Montana communities with affected WWTPs. For this step, DEQ calculated the "Municipal Preliminary Screener (MPS)" value per the guidance for a subset of dischargers reviewed as part of DEQ's demonstration. The MPS is an estimate of the per household cost of proposed pollution controls—that is, meeting base nutrient criteria—plus existing wastewater fees as a percent of median household income for that town (%MHI). If the MPS value for these fees for an average household is equal to or greater than 2% MHI for a given town, then the Guidance suggests possible Substantial impacts and the discharger proceeds to the Secondary test, which is the second major "test" in the Substantial determination. The Guidance also allows a town with an MPS value of 1-2% to proceed on to the Secondary test, because the 1-2% range falls into an "uncertain effect" range.

[1] In **figure 1**, wastewater rates are expressed as a percentage of median household income as of 2011 and are stratified by town size. Communities for this rate comparison were initially selected via a stratified random process for three groups (small, medium, and large communities). More recently, 18 additional communities were added to this sample with a focus on larger and medium towns.

For the Secondary test (step 2), DEQ evaluates a suite of five socioeconomic indicators for each affected town. Montana's Secondary test, as modified from the guidance, looks at the following economic metrics for a given town and compares the town level of each metric to the state average or to the average of a selected sample of towns. The socioeconomic indicators are:

- Poverty Rate
- Low and Moderate Income rate (LMI)
- Unemployment Rate
- Median Household Income (MHI)
- Current local tax and fee burden

LMI is an index number of the percentage of people in a town with an income below 200% of the poverty rate. Lower rates of poverty, LMI, and unemployment indicate a stronger economic situation in a given town. A high MHI does the same. A lower current local tax and fee burden also indicates a stronger economic situation, as more disposable income is generally available to households to be able to afford wastewater treatment improvements.

For each community, each of these five economic indicators are scored as either weak (a score of 1), average (a score of 2) or strong (a score of 3) compared to state averages or averages of a sample of selected Montana towns. The stronger the secondary score numerical rank is (the average score of the five economic metrics), the better able a town is to pay towards for meeting numeric nutrient criteria, and thus taking on a higher wastewater bill. The highest or strongest score a community could get would be a 3.0 (based on scoring a 3 score on all five categories—See **Appendix C**) and lowest would be a 1.0 (based on scoring a 1 score on all five socioeconomic categories). An average score of less than 1.5 for the five indicators is considered an overall weak Secondary score, 1.5 to 2.5 is considered mid-range, and over 2.5 is considered strong according to the Guidance. A weak Secondary score indicates a town with relatively weak economic health compared to the state average. A strong Secondary score indicated a town with a relatively strong economic health compared to the state average.

If a given town generally scored weak on the five indicators, say a 1.4 average value, this would be an indication that the town is already economically challenged and would be more significantly impacted by the higher wastewater rates, and thus more likely face a substantial impact. If it scored generally strong on the five indicators, say a 2.6 average value, this would indicate a town that is strong economically, and therefore the town might not be as significantly affected by additional wastewater fees and may not face a substantial impact (in which case it could better afford the new fees to meet the nutrient criteria). Although initially used in the Municipal Screener to determine if the 2% threshold was met, Median household income is applied differently in the context of the Secondary score and provides a general indicator of the health of the community.

The outcomes of both tests, the Screener and the Secondary test, are then assessed on a matrix (step 3) found in the guidance (**Figure 2**) to determine if water treatment costs to meet standards would cause 'Substantial' economic impact. If a town lands within a check mark or question mark within the matrix, then this constitutes a 'Significant' finding for that town with the affected WWTP. If a town lands on an 'x', then no Significant impact can be found, and the test is done. No variance from the numeric nutrient standards would be granted.

For example, a community with:

a. A mid-range (1.5-2.5) secondary test score and a high (> 2.0%) municipal preliminary screener score, would have substantial economic impact from meeting the new wastewater standards. The town would move on to the Widespread test.
b. A mid-range (1.5-2.5) secondary test score and a low (< 1.0%) municipal preliminary screener score, would not have substantial economic impact from meeting the new standards and no variance would be given.

		Municipal Preliminary Screener		
		> 2.0% (weak)	1.0% - 2.0% (mid-range)	< 1.0% (strong)
Secondary test score	< 1.5 (weak)	✓	✓	?
	1.5 – 2.5 (mid-range)	✓	?	×
	> 2.5 (strong)	?	×	×

✓ = Substantial economic impact
? = Possible substantial economic impact
X = No substantial economic impact

Figure 2. Secondary Score Indicator Matrix from EPA Guidance

The third step in the economic hardship assessment, if a significant impact has been shown, is to demonstrate a 'Widespread' finding for all or almost all Montana communities with affected WWTPs. The guidance calls for a separate "widespread" demonstration that uses a variety of possible economic indicators, but with much more flexibility than the procedure for substantial impacts. The widespread demonstrations should assess the magnitudes of such indicators as increases in unemployment, losses to the local economy, changes in household income, decreases in tax revenues, indirect effects on other businesses, and increases in sewer fees for remaining private entities. While these widespread indicators are examples of things to look at, none are mandatory, and the analyst has discretion as to which to use. The Widespread analysis is discussed in more detail below.

Analysis Sample

Twenty-four publicly owned WWTPs were evaluated as a representative subset of the larger population of 107 affected Montana dischargers. The public dischargers selected for the analysis represented larger communities who are major dischargers with advance treatment systems (> 1MGD), large, medium and small towns who are minor dischargers with advanced treatment systems (< 1 MGD), and lagoon systems. Site specific information on the existing treatment technologies, facility-specific effluent data and community demographics were obtained for this subset and extrapolated to publicly owned plants throughout the state with similar wastewater treatment trains and similar demographics.

Within Montana, the size and types of public wastewater treatment plants vary significantly, ranging from lagoon systems to systems using advanced biological nutrient removal. **Table 2** summarizes the number of major, minor and lagoon public dischargers in the State that would be affected by nutrient criteria, and then breaks down that same distribution within the selected sample. It is clear from the table that the major dischargers were completely represented within the 24 towns selected for analysis, while the lagoons were represented by a small subset of the lagoon total. This was done because it is assumed that all small towns with lagoons would experience significant and widespread impacts from having to meet criteria, while it was unclear whether that would be true for all major and minor dischargers. Therefore, the subsample included towns most likely to not experience economic hardship from having to meet standards, and thus be able to afford to reach base nutrient criteria. This was done to err on the side of being conservative in attaining a hardship finding for the state as a whole.

Table 2. Municipal WWTPs in Montana Affected by Nutrient Criteria

	Major Discharger (Big 7 Towns)	Advanced Discharger > 1 MGD	Advanced Discharger < 1 MGD	Lagoons
All affected Montana Dischargers	7	5	12	83
Percent of total affected WWTPs	6.5%	4.7%	11.2%	77.6%
Subsample	7	5	4	8

To address the first step in the Substantial test, the Municipal Preliminary Screener, DEQ developed a detailed Excel spreadsheet (**Appendix A**) to calculate the annualized capital and operations and maintenance costs (O&M) associated with meeting the base numeric nutrient standards for the 24 sample towns. The spreadsheet also estimated the percent of MHI associated with the increased sewer rates plus current sewer rates. For purposed of this analysis, reverse osmosis was assumed to be technology needed to attain the criteria. Capital and O&M costs for attaining nutrient standards were estimated from the DRAFT Interim WERF study (WERF 2011). **Appendix A** presents two spreadsheets with the calculations and results of the analysis. **Appendix B** documents all the underlying assumptions applied for this demonstration.

The interim WERF study looked at five different levels of nutrient treatment from minimal treatment (level 1) to a treatment that is close to Montana's base criteria (level 5). In fact, level 5 would meet or be superior to some of Montana's criteria shown in **Table 1**. Level 1 treatment in the study is more advanced than lagoons, but still does not directly treat N and P. Level 2 treatment is about the same as the variance levels outlined in SB 367. **Table 3** summarizes the attainable effluent quality and costs of the five different treatment levels from the interim WERF study. **Table 4** summarizes the water treatment processes used in the study for each of those five levels.

Table 3. Effluent Quality and Associated Treatment Costs in the Interim WERF study (WERF 2011)

Level	Description	Capital Cost (million dollars per 1 GPD design flow)	Operations Cost (dollars per day per 1 MGD actual flow)
Level 1	No N and P removal	9.3	250
Level 2	1 mg/l TP; 8 mg/l TN	12.7	350
Level 3	0.1-0.3 mg/l TP; 4-8 mg/l TN	14.4	640
Level 4	<0.1 mg/l TP; 3 mg/l TN	15.3	880
Level 5	<0.01 mg/l TP; 1 mg/l TN	21.8	1370

Table 4. Unit Processes per Treatment Level in WERF Study (WERF 2011)

Level	Liquid Treatment	Solids Treatment	Comment
1	Primary Clarifier Activated Sludge Disinfection Dechlorination	Gravity Belt Thickener Anaerobic Digestion with Cogen Centrifugation	Conventional Activated Sludge for BOD/TSS removal
2	Primary Clarifier Activated Sludge Alum (optional) Disinfection Dechlorination	Gravity Belt Thickener Anaerobic Digestion with Cogen Centrifugation	Nitrification/Denitrification and Biological Phosphorus Removal
3	Primary Clarifier Activated Sludge Methanol (optional) Alum (filtration) Filtration Disinfection Dechlorination	Gravity Belt Thickener Anaerobic Digestion with Cogen Centrifugation	Nitrification/Denitrification and Biological Phosphorus Removal and Filtration
4	Primary Clarifier Activated Sludge Methanol (optional) Alum/Polymer (Enhanced Settling) Enhanced Settling Filtration Disinfection Dechlorination	Fermentation Gravity Belt Thickener Anaerobic Digestion with Cogen Centrifugation	Nitrification/Denitrification and Biological Phosphorus Removal, High Rate Clarification and Denitrification Filtration
5	Primary Clarifier Activated Sludge Methanol (optional) Alum/Polymer (Enhanced Settling) Enhanced Settling Filtration Microfiltration Reverse Osmosis Disinfection Dechlorination	Gravity Belt Thickener Anaerobic Digestion with Cogen Centrifugation	Nitrification/Denitrification and Biological Phosphorus Removal, High Rate Clarification, Denitrification Filtration, and MF/RO on about Half the Flow

Costs for the S&W demonstration were estimated based on the assumption that reverse osmosis (RO) would be the technology used to best meet base nutrient criteria.[2] Current nutrient levels and treatment costs at the 24 sample towns were compared to nutrient levels and costs that would be needed to meet RO based on the WERF study. In this way, annual capital and operations costs needed for meeting base nutrient criteria were applied to each town, and new wastewater bills were calculated for a scenario where towns would have to meet RO and thus attempt to meet base nutrient criteria today. Towns that have lagoons were assumed to have to pay the entire listed costs (per MGD) of Level 5 to get to the criteria (use RO). Towns currently with advanced treatment were assumed to have already paid for some of the Level 5 costs. If a town already met WERF level 2 nutrient levels, for example, then the level 2 costs for both capital and operations were subtracted from level 5 costs. It is important to note that the operations costs of meeting base numeric criteria taken from the WERF study (**Table 3**) do not include labor and maintenance costs, so the costs estimates may be slightly low (conservative). This is addressed below. WERF level 5 is not quite as stringent as many of the Montana base nutrient criteria, so the costs to reach nutrient standards estimated for this demonstration are potentially underestimated in that sense as well, which is also addressed below.

RESULTS

SUBSTANTIAL IMPACT

Table 5 presents the Municipal Preliminary Screener results for the 24 communities evaluated in the analysis if they had to meet base numeric nutrient criteria. DEQ first examined the MHI results that would be incurred by the largest seven Montana towns (Billings, Great Falls, Missoula, Bozeman, Butte, Helena, and Kalispell). Missoula was assumed to already meet the criteria on the Clark Fork due to dilution (the only affected town to do so out of the 107), but was included anyway. The rationale for this approach was that if any WWTP could afford meeting numeric nutrient criteria, it would be Montana's largest towns due to the already-sophisticated systems in place and/or large populations across which additional costs could be dispersed (i.e., economies of scale). Differences in the resulting MHI levels for these seven towns (and all Montana towns) include current levels of nutrient treatment, town population, current MHI, and current wastewater fees. Based on our analysis, five out of seven of the largest towns in Montana would score over the 2% MHI threshold to meet base criteria (**Table 2**). Missoula (which already meets the standard) and Helena do not. Lolo also comes in under 2%. The three towns in the sample that would not hit the 2% threshold are highlighted in blue. All smaller towns with lagoons scored more than 2% MHI. The breakout of all 24 towns is given below.

[2] A 'Pilot Study for Low Level Phosphorus Removal' ([2010] Hal Schmidt, P.E.MWH Americas, Inc.), conducted in Florida shows that for TP, TN, and other micro-pollutants, RO was indeed the most effective method for removing TN and TP (better than membrane bioreactor, MBR). Dave Clark of HDR Engineering, agreed that RO is the treatment that results in the lowest TN levels, and that the WERF report accurately reflects capital and operations costs for RO. Thus, this study assumes the use of RO technology for this demonstration of economic hardship. (It is important to note that this does not mean that Montana WWTPs would be expected to implement RO to meet practical Limits of Technology [LOT] or nutrient criteria in practice.)

Table 5. % MHI Results for towns to reach Base Criteria

Community	Expected % MHI	Population	MGD (Design Flow)
The Big Seven Montana Towns			
Kalispell	2.58%	$39,953	5.4
Bozeman	2.92%	$41,661	13.8
Helena	1.74%	$47,152	5.4
Butte	2.15%	$37,335	8.5
Billings	2.41%	$45,004	26
Missoula	1.47%	$34,319	12
Great Falls	4.18%	$40,718	26
Other Large Montana Facilities > 1 MGD			
Livingston	6.85%	$35,689	5
Miles City	4.09%	$37,554	3.7
Hamilton	5.44%	$25,161	1.98
Lewistown	3.43%	$31,729	2.5
Havre	2.04%	$43,577	4.4
Non Lagoon Facilities < 1 MGD			
Columbia Falls	3.02%	$38,750	0.766
Manhattan	2.60%	$50,729	0.6
Lolo	1.81%	$46442	0.34
Stephensville	3.17%	33776	0.3
Lagoons			
Philipsburg	4.19%	$31,375	0.2
Cut Bank	2.68%	$44,833	0.643
Deer Lodge	3.89%	$40,320	3.3
Glendive	3.67%	$42,821	1.3
Red Lodge	5.16%	$50,123	1.2
Big Fork	2.65%	$44,398	0.5
Highwood	2.54%	$62,614	0.026
Circle	5.47%	$29,000	0.16

From the analysis is it clear that small towns in Montana, which comprise the vast majority of affected WWTPs in Montana (78%), would all exceed the 2% MHI threshold (Municipal Preliminary Screener). It is also important to note that the costs to reach WERF Level 5 underestimate the cost to reach nutrient criteria. **Figure 3** shows a plot of the 24 town sample comparing population to %MHI. The vertical red line shows the 2% MHI cost level. The main trend that stands out is that the largest towns (the seven points at or above the 20,000 population mark) would pay between 1.8% and 4% MHI to meet the nutrient criteria while all other towns in the sample cover a wider range of between 1.8% and almost 7%. Also, smaller towns in the sample scored a higher average MHI percent overall than the largest seven towns. This strongly suggests that smaller towns would all bear higher than a 2% MHI to reach base numeric criteria. **Figure 4** shows the estimated percentage increases in wastewater bills from having to meet criteria. (Note: Including town names in the figures was visually too crowded).

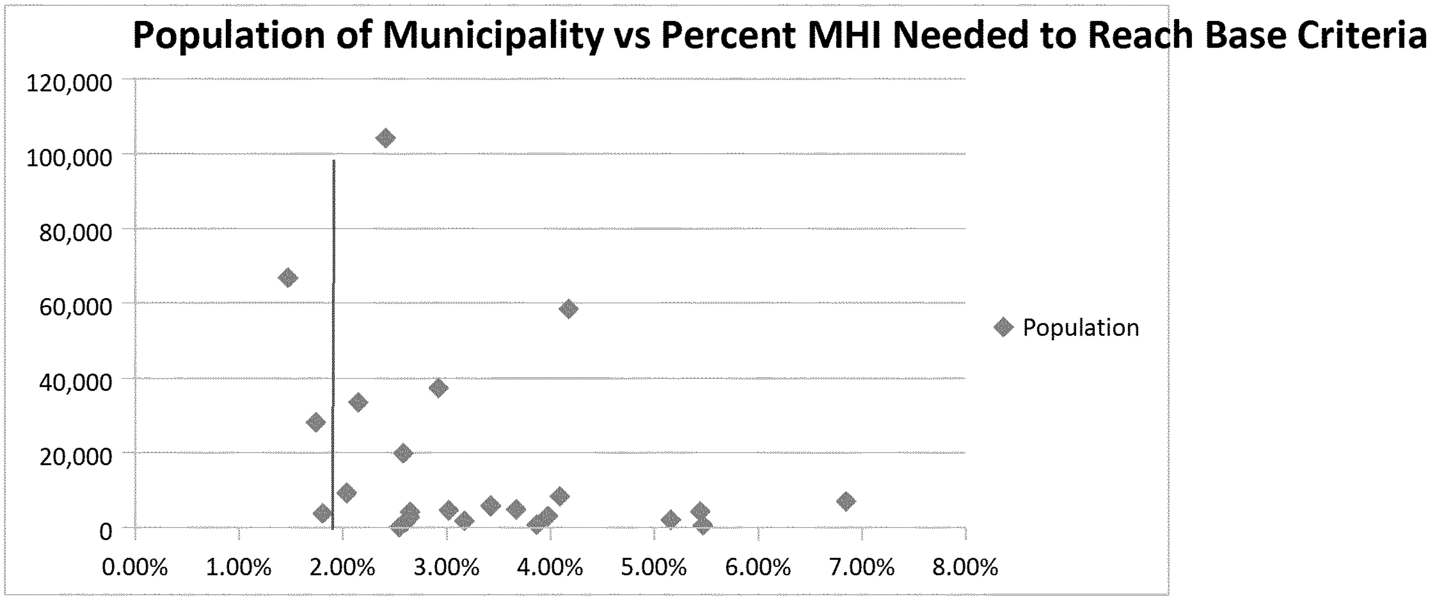

Figure 3. Population Versus Percent MHI Needed to Reach Base Nutrient Criteria

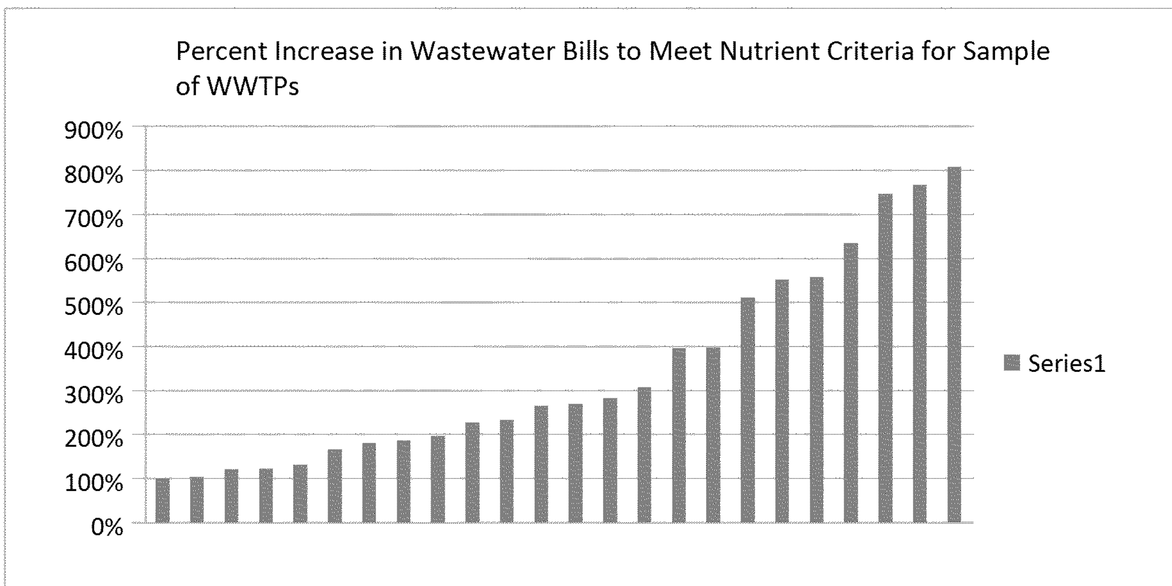

Figure 4. Percent Increase in Wastewater Bills to Meet Nutrient Criteria

SENSITIVITY ANALYSIS OF MUNICIPAL PRELIMINARY SCREENER

The demonstration so far has presented the results of expected treatment costs—the percentage MHI—as a single value. Because of the uncertainty associated with the underlying assumptions, we provide a range of values based on alternate, reasonable assumptions. Three 'alternate' assumptions are given, and those assumptions are combined in various ways to calculated alternate MHI values for each of the 24 towns and thus provide ranges for MHI.

Alternate Assumption #1: Discount Rate

DEQ assumed an alternative discount rate of seven percent for capital expenditures on new wastewater treatment equipment compared to the 5 percent modeled in DEQ's original analysis. In many cases, five percent interest is an appropriate discount rate to annualize the capital costs at the national level, but may not be appropriate for bonds that would be issued by smaller communities. Additionally, there exists some uncertainty on the rate depending on the general economic conditions at the time the bonds are issued and the debt capacity and rating of the borrower.

Alternate Assumption #2: Labor Costs

DEQ assumed the inclusion of labor costs of 15 and 48 percent of capital costs. The original DEQ analysis did not include labor costs, which can be a significant cost for a treatment process. The reason for this is those costs were not included in the WERF study. An analysis of the life-cycle costs for a number of technologies used to control nitrogen and phosphorus in wastewater treatment plants estimated that labor costs are between 15-21 percent of the annualized capital costs for nitrogen and 15-48 percent of annualized capital costs for phosphorus.[3] A range of 15% to 48% is used to add on to total costs.

Alternate Assumption #3: Reverse Osmosis

The WERF study, which was the basis for the costs in this study, included RO treatment for 50 percent of the flow after treatment Level 4. The treatment levels 1 through 4 represented progressively greater levels of treatment for each successive level. This was represented by the inclusion of additional unit processes (e.g., level 4 is the same as level 3 with some added processes to achieve more reduction of nutrients). Level 5 did not exactly follow this progression, since half of the flow remained treated by processes equivalent to Level 4 and the other half received an enhanced level of treatment (reverse osmosis or RO).

To meet the MT criteria, which are more stringent for TN than WERF level 5, one could assume that the highest level of treatment was needed for 100 percent of the flow--not half as specified in the cost analysis in the WERF study. Thus, cost estimates could be based on providing RO treatment to 100 percent of flow rather than 50% of flow, in order for WWTPs to achieve the Montana nutrient criteria. While it may be possible that some facilities' waste streams and effluent levels would not require 100 percent RO treatment, simulating at 50 and 100 percent provides an upper bounds estimate of the potential economic impact of the Montana nutrient criteria.
The WERF data were adapted to estimate the cost of treating all flow by RO by isolating the marginal unit processes used for Level 4 and Level 5 and calculating the cost for a treatment train with 100 percent RO.

SCENARIOS

For this analysis, multiple estimated treatment costs as a percentage of MHI values were calculated based on five additional scenarios to the original DEQ scenario (see **Table 6**). As explained below, the discount rate was varied from 5 to 7 percent and the addition of both high (48 percent) and low (15 percent) labor costs as a percentage of capital costs were considered across each scenario. Then, the 100% RO is added on to the original estimates separately to isolate how that assumption alone would affect costs.

[3] POINT SOURCE STRATEGIES FOR NUTRIENT REDUCTION. TMDL Workshop. February 17, 2011. S. Joh Kang, Ph.D., P.E. and K. Olmstead, Ph.D., P.E. Tetra Tech Inc. Ann Arbor, MI. (Based on information in: Introduction of Nutrient Removal technologies Manual, EPA, 2008 and WEF/WERF Cooperative Study of Nutrient Removal Plants: Achievable Technology Performance Statistics for Low Effluent Limits)

Table 6. Scenarios for Sensitivity Analysis

Scenario	Description	Discount Rate	Labor Cost
Original	5% discount rate and 0% labor cost	5%	0%
Scenario A	Change of labor cost to 48% of capital cost	5%	48%
Scenario B	Change of labor cost to 15% of capital cost	5%	15%
Scenario C	Discount rate increase from 5% - 7%	7%	0%
Scenario D	Discount rate increase from 5% - 7% AND change of labor cost to 48% of capital cost	7%	48%
Scenario E	Discount rate increase from 5% - 7% AND change of labor cost to 15% of capital cost	7%	15%

Results of Sensitivity Analysis

Figures 5 and **6** below present the results from Scenarios A-E. **Figure 5** shows the original MTDEQ analysis and the 5 scenarios percent MHI values for all communities. **Figure 6** is a condensed presentation of the results that displays the percent MHI results for the original scenario, the average of all scenarios, and minimum, median, and maximum values (indicated by the gray boxes on the figure), and the original MHI with 100% of treated water going through Reverse Osmosis.

It is clear that all of the communities included except for Missoula would be above the 2 percent MHI threshold under all alternate scenarios. As mentioned before, Missoula already appears to be meeting nutrient criteria. The analysis demonstrates that the two POTWs that were not above the 2 percent threshold in the original MTDEQ analysis (Havre, Helena), would most likely be above the threshold when uncertainty in the data and additional factors are taken into account.

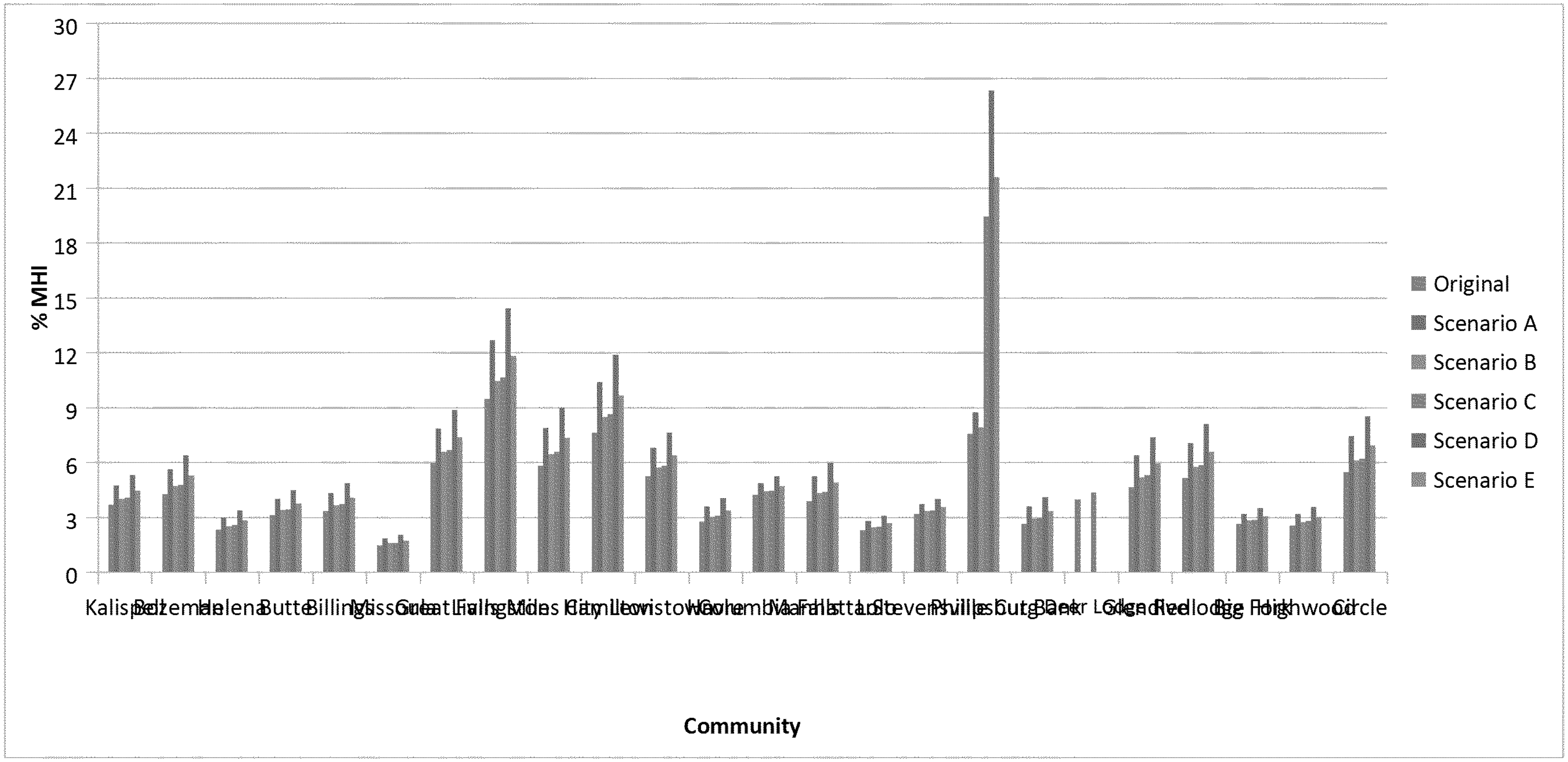

Figure 5. Expected % MHI to Meet Base Numeric Nutrient Criteria (plus current wastewater fees)

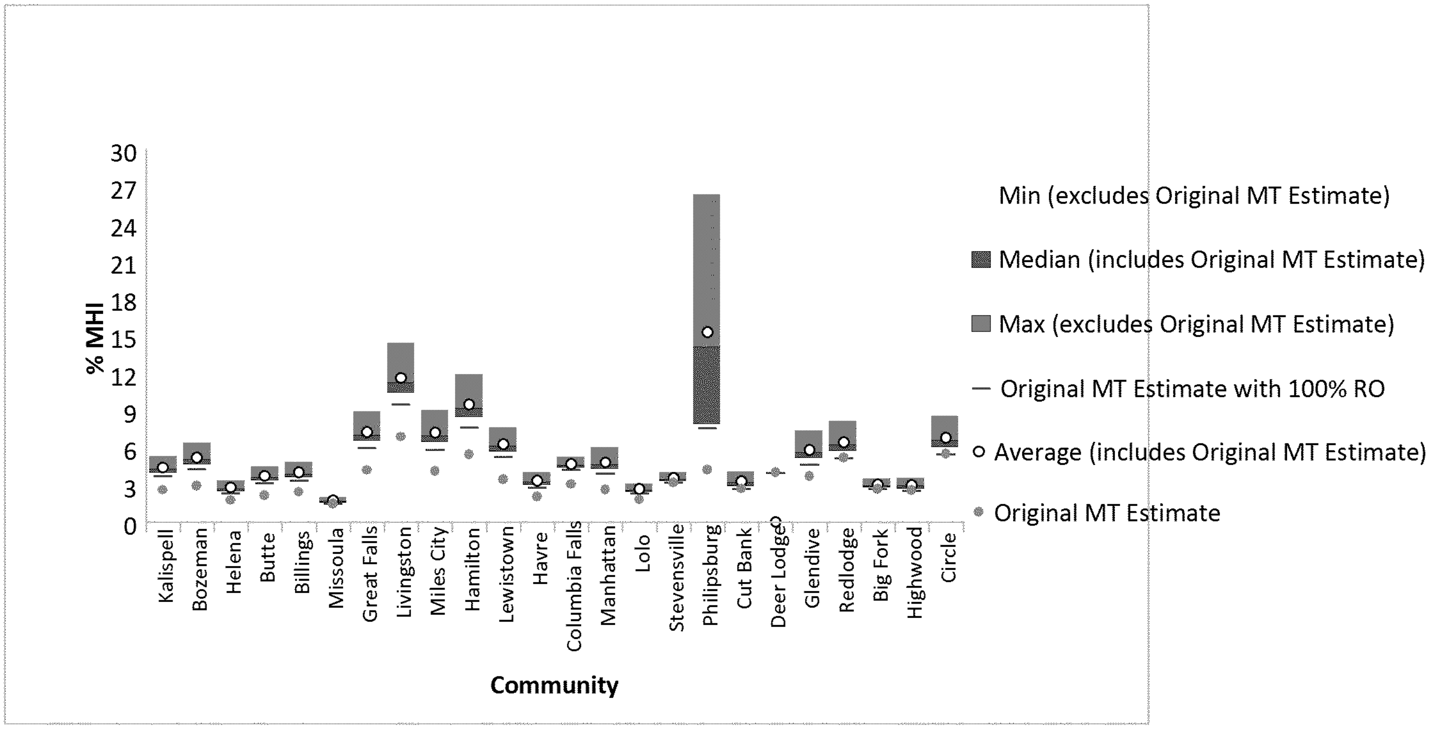

Figure 6. Expected % MHI to Meet Base Numeric Nutrient Criteria (plus current wastewater fees) - Condensed Presentation

CALCULATION OF THE SECONDARY SCORE

The second step in demonstrating Substantial effects from meeting nutrient criteria involves evaluating a community's current economic health. This is referred to in the guidance as the Secondary Score (**Figure 7A**). DEQ calculated the secondary score values for the 24 sample communities (listed in **Table 5**) by obtaining data from the following sources. **Appendix C** provides the secondary scores for each community, along with the total secondary score value and the five socioeconomic indicators.

Out of the sample of 24, no town comes in below 1% MHI to meet nutrient criteria thereby eliminating two of the three 'x' squares in the matrix. No town with a strong secondary test score comes in under 2% MHI for meeting nutrient criteria eliminating the third x. Thus no towns fall in a square with an x. This means that all 24 towns would experience a Substantial or Possible Substantial impact from having to meet nutrient criteria. In fact, most towns fall within the square that is the check mark in the middle left square. **Figure 7B** shows the matrix and the number of towns out of 24 that fall within each corresponding square of the matrix.

Table 7. Data Sources for the Secondary Score Indicators

Secondary Score Indicator	Data Source	Notes and Web link
Poverty Rate	Montana Census Data, Montana Census and Economic Information Center (MT CEIC); 2009 American Community Survey Data and Social Explorer website	http://ceic.mt.gov/Demographics.asp http://www.census.gov/prod/2010pubs/acsbr09-1.pdf http://www.socialexplorer.com
Low and Moderate Income rate (LMI)	2005-2009 American Community Survey 5-Year Estimates	LMI was calculated by DEQ by taking the number of persons who live below 200% of the poverty level threshold for a town, and dividing by the total number of persons in a town
Unemployment Rate	Source: Montana Department of Labor and Industry Research and Analysis Bureau, Aaron McNay.	http://www.ourfactsyourfuture.org/ Montana: http://www.ourfactsyourfuture.org/cgi/databrowsing/?PAGEID=4&SUBID=123
Median Household Income	Montana Census Data (MT CEIC), U.S. Census Bureau, American Community Survey 5-Year Estimate (2005-2009); Small Area Income and Poverty Estimates	http://www.census.gov/hhes/www/saipe/index.html
Current local tax and fee burden	Annual Financial Reports of the Cities and Towns of Montana, sheet entitled "Government-wide Statement of Activity", Local Government Services Bureau, Dept of Administration, State of Montana, Kim Smith, (406) 841-2905.	DEQ calculated an index based on current local taxes and fees plus local property taxes, indexed by population and MHI to normalize towns. A histogram of all towns (using the normal distribution) in the “tax index sample’ (39 towns total) created a weak, medium and strong score for each town compared to the sample average

		Municipal Preliminary Screener		
		> 2.0% (weak)	1.0% - 2.0% (mid-range)	< 1.0% (strong)
Secondary test score	< 1.5 (weak)	✓	✓	?
	1.5 – 2.5 (mid-range)	✓	?	×
	> 2.5 (strong)	?	×	×

✓ = Substantial economic impact
? = Possible substantial economic impact
X = No substantial economic impact

Figure 7A. Secondary Score Indicator Matrix.

	2.0% (weak)	1.0%-2.0% (mid-range)	<1.0% (strong)
< 1.5 (weak)	1	0	0
1.5-2.5 (mid-range)	**18**	3	0
>2.5 (strong)	2	0	0

Figure 7B. Where the 24 Sampled Towns Fell within the Matrix.

Secondary score values for the 24 Montana towns sampled ranged between 1.2 and 3.0 (**Table 8**). Larger towns (i.e, Billings, Bozeman, Helena, Great Falls, Missoula) had secondary scores between 1.8 and 2.4 thus falling in the mid-range. Combined with the MPS results, 24 out of 24 of the sample communities were considered to be “substantially” affected by requirements to meet the numeric nutrient criteria. Again, towns falling into a matrix square with a question mark are considered to have a borderline substantial impact. For more info on the Secondary scores for the 24 towns, see **Appendix C**.

Table 8. Secondary Scores for sample MT communities

Community	Secondary Score	MHI %
Kalispell	1.8	2.58%
Bozeman	2.0	2.92%
Helena	2.4	1.74%
Butte	2.0	2.15%
Billings	2.2	2.41%
Missoula	1.8	1.47%
Great Falls	2.0	4.18%
Livingston	1.6	6.85%
Miles City	2.0	4.09%
Hamilton	1.2	5.44%
Lewistown	2.0	3.43%
Havre	2.0	2.04%
Columbia Falls	1.8	3.02%
Manhattan	2.2	2.60%

Lolo	2.0	1.81%
Stephensville	1.6	3.17%
Philipsburg	1.6	3.87%
Cut Bank	1.6	2.65%
Deer Lodge	2.0	3.98%
Glendive	2.2	3.67%
Red Lodge	2.2	5.16%
Big Fork	2.25	2.65%
Highwood	3.0	2.54%
Circle	2.0	5.47%

As demonstrated above, no towns in Montana would score a strong Secondary score and less than 2% MHI (both of which would need to happen for a finding of non-Significant impact). Indeed, only three towns scored less than 2% MHI, and none of those has a strong secondary score. This is likely to be the case for all of Montana, as almost every town will score greater than 2% MHI and thus gain a significant finding per the matrix in the guidance. Thus, because it is estimated that step one and step two are met for 100% of affected Montana towns, a substantial impact has been demonstrated. We have shown this to be the case for virtually every town in Montana.

WIDESPREAD ANALYSIS

The third major metric in the S&W demonstration is the widespread test. The guidance does not provide direct ratios or specific tests for a Widespread finding, nor does it provide a straightforward method of proving Widespread impacts (as it does for a Substantial finding). In addition, it suggests looking at some of the economic metrics that are used in the two Substantial tests. From the guidance:

> "The financial impacts of undertaking pollution controls could potentially cause far-reaching and serious socioeconomic impacts. If the financial tests outlined in Chapter 2 and 3 suggest that a discharger (public or private) or group of dischargers will have difficulty paying for pollution controls, then an additional analysis must be performed to demonstrate that there will be widespread adverse impacts on the community or surrounding area. There are no economic ratios per se that evaluate socioeconomic impacts. Instead, the relative magnitudes of indicators such as increases in unemployment, losses to the local economy, changes in household income, decreases in tax revenues, indirect effects on other businesses, and increases in sewer fees for remaining private entities should be taken into account when deciding whether impacts could be considered widespread. Since EPA does not have standardized tests and benchmarks with which to measure these impacts, the following guidance is provided as an example of the types of information that should be considered when reviewing impacts on the surrounding community." (Chapter 4, first paragraph, found at http://water.epa.gov/scitech/swguidance/standards/economics/chaptr4.cfm)

DEQ considered the widespread analysis based on the following basic question: For Montana towns, which would all be Substantially affected by having to meet base numeric nutrient criteria, what are the economic and social ripple effects of that substantial impact on the local area? An important step in this question was to define the geographic area where project costs pass through to the local economy. For Montana's widespread analysis, DEQ established the entire state as the "geographic area" considered in the widespread demonstration.

The Widespread argument was made for all towns together rather than individual towns, due to the impracticality of showing widespread impact for each of the 24 towns in the sample, much less all 107 affected towns. Widespread Impacts were evaluated by their cumulative effect and by the DEQ analyst's Best Professional Judgment. Most towns are small and rural or small and a suburb of a larger town. Statewide, there are approximately 95 small towns (under 5,000 in population) out of the affected 107. The other 13 affected towns are "medium to large" and are more urban-based with more diverse economies. Six of these thirteen towns have more than 20,000 in population and a seventh town (Kalispell) is at an estimated 19,927 persons (Montana CEIC, American Community Survey). The other six are between 5,000 and 10,000 in population (see **Table 9**).

Table 9. Population Distribution of all 107 Affected Towns

	Large Towns (20,000 persons and over)	**Medium Towns (between 5,000 and 10,000 persons)**	**Small Towns (under 5,000 persons)**
Number	7	6	94
Percentage of Total affect towns	6.5%	5.6%	87.9%
Percentage of Montana households that would be affected by Nutrient Criteria – 50% (approximately)			

DEQ believes that at least 95% of the 107 affected Montana towns (104 out of 107) would experience widespread impacts by having to meet base numeric nutrient standards today. DEQ's Widespread argument is as follows.

- The fact that almost every town in Montana (estimated 104 out of 107) would experience a cost of 2% or greater MHI from having to meet numeric nutrient criteria suggests widespread impacts across the state. Of the 24 communities examined, 21 showed a 2% MHI or greater, and almost certainly the other 86 towns of the 107 towns would as well (smaller and most with lagoons). With alternate assumptions, 23 out of 24 showed a 2% or higher MHI. The aggregated effects of the 2% MHI or greater on such a large number of individual communities would likely result in widespread effects at the statewide scale.
- Most small towns (< 5,000) have agricultural-based economies and use lagoons for wastewater treatment. The cost of achieving standards relative to MHI will be much higher than 2% for many of these small towns considering that most have lagoons that would need complete, major upgrades (including abandonment of the lagoon) and most have small populations over which to spread that cost. Many of these towns are currently losing population and business, especially in the eastern portion of the state. In addition, these small towns already currently have higher sewer rates within the state (on average) than the largest seven towns.
- Montana is currently 41st in the nation in per capita income as of 2009 at $22,881 (Data Set: 2005-2009 American Community Survey 5-Year Estimates, American Community Survey, Montana CEIC). Prices in Montana are about average for the U.S. across all goods. Montanans on average do not have as much disposable income as the average American, and may have slightly higher living expenses due to long travel distances and higher heating bills.
- All affected towns but one in Montana (the one that already meets criteria) would pay at least 2% MHI in their total wastewater bill to meet base numeric nutrient standards, or significantly more than they are currently paying on average (current bills average about 0.9% across Montana). Thus, wastewater bills would at least double on average for affected communities to meet the numeric nutrient criteria. In a state with less disposable income than the U.S. average,

a greater than 1% decrease in disposable income on average due to higher bills will produce widespread effects on households and businesses (some businesses more than others). A substantial increase in the wastewater bill could tip the scales for a percentage of residences based on decreased disposable income as a result of the increase in the wastewater bill. Residences below the MHI for a town could be hit especially hard.

- Town residents are used to small increases in utility bills. Having to meet nutrient criteria would cause a very large increase in most utility bills, and likely public outcry. As an example, a doubling of electric rates for members of the SME electric utility has resulted in a high-profile public battle.
- Since most small towns do not have diverse economies, even a small decrease in business and in population can have a large effect on small towns that are struggling. For example, some small Montana towns have less than 10 businesses total. Future businesses and homes could self-locate out of town to avoid high wastewater fees, although that is speculative.
- It is assumed that all towns under 5,000 persons would experience Widespread impacts.
- Towns with populations over 5,000 will likely show mixed results in terms of Widespread impact. The six large towns affected by nutrient criteria would experience Widespread impacts in terms of disposable income, but possibly not overall (e.g. would not see their economy collapse). In other words, these large towns would not shut down, but certain residences and businesses would experience substantial impacts. Another 12 or so medium to large towns would probably experience Widespread impacts overall for the same reasons as discussed above, but less severe impacts than the 95 smaller towns with affected WWTPs.
- The current Recession could complicate these effects. Even if one-third of these medium to large towns did not experience Widespread impacts per the guidance (4 total), more than 95% of Montana's affected towns still would meet the 'almost all' threshold for Widespread impacts, while all meet the criteria for Significant impacts.
- To meet the base numeric nutrient criteria will require hiring highly qualified wastewater engineers in each affected town. There could be widespread impacts associated with finding these qualified staff for facilities across the state and then paying them a competitive salary. Such operators may be hard to find for small Montana towns.
- The 2010 census data showed that Montana's population is aging. This trend, coupled with increased living expenses associated with meeting the base nutrient standards, could have negative impacts on a statewide scale.
- Small towns in Montana are struggling in certain cases to get basic infrastructure like broadband internet. A large jump in wastewater infrastructure costs could halt that progress.
- DEQ's substantial and widespread analysis assumed that reverse osmosis or some ion exchange treatment technology would be required. Either technology is both economically and environmentally costly. Reverse osmosis generates brine that must be disposed of properly and results in significantly higher greenhouse gas emissions. Aggregated at the statewide scale, both the economic and environmental implications of meeting Montana's criteria would have widespread impacts for the State of Montana.
- Benefits from meeting base numeric standards would likely not be widespread in terms of economics. Jobs created would be greatest in the short term for construction, and long-term jobs would tend to be small in relation to an area's entire work force, except for the smallest of towns. Environmental benefits would be widespread.

CONCLUSIONS

This demonstration shows that meeting the numeric nutrient criteria on a statewide basis would result in Substantial and Widespread economic impacts to Montanans (for public sector). Of the 24 publicly-owned dischargers reviewed in this analysis, 100% of them demonstrated Substantial impacts and at least 20 would likely demonstrate Widespread Economic impacts. DEQ believes that if 95% of the communities demonstrate Substantial and Widespread impacts, which this paper has done, then DEQ has shown economic hardship at the statewide scale.

REFERENCES

EPA, 1995. "Interim Economic Guidance-Workbook", Environmental Protection Agency, EPA-823-B-95-002; March 1995

WERF, 2011. "Striking the Balance between Wastewater Treatment Nutrient Removal and Sustainability-DRAFT", Michael W. Falk, JB Neethling, David J. Reardon; HDR Engineering. Written for the Water Environmental Research Foundation.

APPENDIX A - SPREADSHEETS OF COSTS AND MHI

Table A-1. Summary Demographic Data for the Sample Towns Including Current Wastewater

Community	Median Household Income (2010) - countywide MHI. Recommend updating for service area.	Population	Estimated Number of Households (Population / 2.5) based on 2000 Census	Current Average Annual Household Wastewater Bill	Design Flow (MGD)	Actual Flow (MGD)	Current wastewater MHI	Percent MHI needed to get to RO/Base Numeric Nutrient Criteria (including current fees)
Kalispell	$39,953.00	19,927	7,705	$216.00	5.4	3.10	0.54%	2.58%
Bozeman	$41,661.00	37,280	14,614	$372.00	13.8	5.80	0.89%	2.92%
Helena	$47,152.00	28,190	12,337	$265.44	5.4	3.00	0.56%	1.74%
Butte	$37,335.00	33,525	14,041	$360.00	8.5	4.00	0.96%	2.15%
Billings	$45,004.00	104,170	41,841	$218.28	26	26	0.49%	2.41%
Missoula	$34,319.00	66,788	27,553	$152.14	12	9	0.44%	1.47%
Great Falls	$40,718.00	58,505	23,998	$187.20	26	26	0.46%	4.18%
Livingston	$35,689.00	7,044	3,188	$600.00	5	2	1.68%	6.85%
Miles City	$37,554.00	8,410	3,518	$236.10	3.7	2	0.63%	4.09%
Hamilton	$25,161.00	4,348	2,092	$276.00	1.98	0.68	1.10%	5.44%
Lewistown	$31,729.00	5,901	2,727	$387.60	2.5	1.5	1.22%	3.43%
Havre	$43,577.00	9,310	3,709	$240.00	1.8	1	0.55%	2.04%
Columbia Falls	$38,750.00	4,688	1,621	$532.20	0.766	0.37	1.37%	3.02%
Manhattan	$50,729.00	1,520	523	$362.40	0.6	0.4	0.71%	2.60%
Lolo	$46,442.00	3,892	1,060	$363.00	0.34	0.38	0.78%	1.81%
Stevensville	$33,776.00	1,809	795	$535.08	0.3	0.29	1.58%	3.17%
Philipsburg	$31,375.00	820	399	$200.00	0.2	0.2	0.64%	4.19%
Cut Bank	$44,833.00	2,869	1,290	$138.48	0.643	0.643	0.31%	2.68%
Deer Lodge	$40,320.00	3,111	1,522	$409.56	3.3		1.02%	3.89%
Glendive	$42,821.00	4935	1,883	$213.96	1.3	N/A	0.50%	3.67%
Redlodge	$50,123.00	2125	1,055	$305.28	1.2	0.65	0.61%	5.16%
Big Fork	$44,398.00	4270	1,708	$580.36	0.5		1.31%	2.65%
Highwood	$62,614.00	176	53	$600.00	0.026	0.015	0.96%	2.54%
Circle	$29,000.00	615	234	$259.56	0.16	0.065	0.90%	5.47%

Free

Table A-2. Detailed Costs for the Sample Towns of Meeting Criteria (next three pages)

Community	Current Treatment Technology	Design Flow (MGD)	Actual Flow (MGD)	Capital cost (million dollars) to meet the numeric nutrient criteria (WERF)	Annual Capital cost to meet the numeric nutrient criteria (L4 WERF) (dollars)	Annual Operations costs to meet the numeric nutrient criteria L4WERF (dollars)	Annual Capital and Operations cost ($)	Annual Additional Cost per Household (increase in sewer rate)	Predicted average household sewer fee to meet criteria	Expected % MHI to Meet Base Numeric Nutrient Criteria (plus current wastewater fees)	Percent increase in Wastewater bill
Big 7 Communities											
Kalispell	BNR (modified Johannesburg); 3.1 to 5.4 MGD; ~WERF Level 2--avg. .12 mg/l TP; 10 mg/l TN.	5.4	3.10	49.14	$3,941,028	$1,228,530	$5,169,558	$671	$1,033	2.58	186%
Bozeman	Some BNR now; 5-stage Barrdenpho; new plant will be ~WERF Level 2 on average--BNR (1 mg/l TP; 3 mg/l TN starting 2011); current 5.8 mgd; increasing to 13.9 mgd	13.8	5.80	125.58	$10,071,516	$2,298,540	$12,370,056	$846	$1,218	2.92	228%
Helena	BNR; ~ WERF Level 1--3 mg/l TP; 10 mg/l TN; design capacity of 5.4; current discharge ~3.0 MGD	5.4	3.00	67.50	$5,413,500	$1,298,400	$6,711,900	$544	$822	1.74	196%
Butte	Current technology is activated sludge (TN of 18.5 mg/l; TP of 2.11 mg/l); under Order to Construct to membrane BNR; current design is 8.5 MGD. Included in current fee is $27 million upgrade in new capital costs and $1.125 million in O&M costs which would bring them to 5 TN and 0.1 TP or ~WERF Level 3	8.5	4.00	62.90	$5,044,580	$1,161,800	$6,206,380	$442	$802	2.15	123%
Billings	Secondary treatment; Design flow of 26 MGD (avg.) and 40 MGD max. Costs are estimated from HDR.	26	26	312.50	$25,062,500	$11,252,800	$36,315,300	$868	$1,086	2.41	398%
Missoula	Already meets nutrient criteria in Clark Fork with mixing zone. Advanced secondary treatment facility with biological nutrient removal and ultraviolet disinfection. 8.2 mg/l TN; 0.16 -0.4 mg/l TP; get a mixing zone, meeting criteria currently. BNR. Design flow = 12 MGD ; actual flow = 9 MGD. (designed for 10 and 1). (HDR)	12	9	88.80	$7,121,760	$2,614,050	$9,735,810	$353	$505	1.47	232%
Great Falls	At WERF 1. Conventional Secondary activated sludge (max 21-MGD; avg. 10 MGD). Cost data from HDR.	26	26	312.50	$25,062,500	$11,252,800	$36,315,300	$1,513	$1,700	4.18	808%

Other Large Communities > 1 MGD											
Livingston	Assume WERF Level 1. Discharges into the Yellowstone; permit renewed in 2010; mechanical plant w/ 2 primary clarifiers, 3 rotating biological contactors, UV, installing co-composting. DMR shows 11 mg/l TN average (20 mg/l for May) and 2 mg/l TP (3 mg/l for May).	5	2	62.50	$5,012,500	$865,600	$5,878,100	$1,844	$2,444	**6.85**	307%
Miles City	Assume WERF 1. Secondary treatment plus oxidation ditch. 2011 permit. Algae plant study to remove nutrients. Extended aeration system w/2 oxidation ditches w/rotating brush aerators; 2 clarifiers and chlorine basin. TN avg of 23.5 mg/l; TP avg. 3.6 mg/l.	3.7	2	46.25	$3,709,250	$865,600	$4,574,850	$1,300	$1,537	**4.09**	551%
Hamilton	Assume WERF 2 (TN WERF 3 and TP WERF 1). BNR facility w/ extended aeration system. Oxidation ditch w/ rorating brush aerators. 3 clarifiers. Upgraded in 2010. TN avg. 5.5 mg/l; TP avg. 5 mg/l.	1.98	0.68	24.75	$1,984,950	$301,984	$2,286,934	$1,093	$1,369	**5.44**	396%
Lewistown	Assume WERF 3 based on current levels. BNR plant. Focus on TP removal. 0.8 mg/l TP; 3-4 mg/l TN.	2.5	1.5	18.50	$1,483,700	$423,675	$1,907,375	$699	$1,087	**3.43**	180%
Havre	Assumed WERF Level 1. Discharges into the Milk River. Permit renewed in 2011. Activated sludge facility with effluent chlorination. 2006-2010 data showed avg. TP of 3.4 (TN not required). 2011 DMR showed TN of 19.4 mgl; Tp of 1.3 mg/l.	1.8	1.38	$22.50	$1,804,500	$597,264	$2,401,764	$648	$888	**2.04**	270%
Non-Lagoon Facilities with < 1MGD											
Columbia Falls	Assume WERF Level 3. Newer plant with good control. Designed to achieve 8 mg/l TN	0.766	0.37	$5.67	$454,606	$580,900	$1,035,506	$639	$1,171	**3.02**	120%
Manhattan	Assumed WERF Level 2. Discharges into Diva Ditch. Permit renewed in 2010. Denitrification with fixed film suspended growth system, clarifiers and aerobic sludge digestion, UV. DMR data from winter quarter shows 11 mg/l TN and 1 mg/l TP. 2008-2010 showed avg. TN of 14 mg/l TN	0.6	0.4	$5.46	$437,892	$63,408	$501,300	$959	$1,321	**2.60**	264%
Lolo	WERF Level 1. No steps towards nutrient removal. For Lolo, TN is generally less than 30 mg/l and TP less than 7. Generally heaving loadings for Lolo. Sewer rates--Lolo $30.25-ish/mo - (RSID) based on property values	0.34	0.38	$4.25	$340,850	$164,464	$505,314	$477	$840	**1.81**	131%
Stevensville	WERF Level 1. TN generally below 20 and TP less than 4.	0.3	0.29	$3.75	$300,750	$125,512	$426,262	$536	$1,071	**3.17**	100%

Lagoons											
Philipsburg	WERF 1--Lagoon - ref: Gary Swanson, consulting engineer- 15TN, 2TP	0.2	0.2	$4.36	$ 349,672.00	94,810.00	$444,482.00	$1,114	$1,314	4.19	557%
Cut Bank	WERF 0--Lagoon.	0.643	0.643	$14.02	$1,124,195.48	246,140.40	$1,370,335.88	$1,062	$1,201	2.68	767%
Deer Lodge	WERF Level 0. Moving from an existing lagoon to mechanical plant with land application. Ref: planning document--To get to variance only. Because this would be a land application system, so theoretically, the N and P would be zero to the Clark Fork	3.3	1.06	$71.94	$1,261,145.00	$502,493.00	$1,763,638.00	$1,159	$1,568	3.89	283%
Glendive	WERF Level 0. Domestic WW lagoon; 3 cell facultative; current O&M costs are <$; 8-10 capital costs for new plant. O&M increase of ~$300,000. new avg. 1.15 MGD; PER completed to upgrade to mechanical SBR or BNR plant.	1.3	0.6	$28.34	$2,272,868.00	$284,430.00	$2,557,298.00	$1,358	$1,572	3.67	635%
Red Lodge	WERF Level 0--Lagoon.	1.2	0.65	$26.16	$2,098,032.00	$308,132.50	$2,406,164.50	$2,281	$2,586	5.16	747%
Big Fork	WERF Level 0--Lagoon.	0.5	0.3	$10.90	$874,180.00	$142,215.00	$1,016,395.00	$595	$1,175	2.65	103%
Highwood	WERF Level 0--Lagoon.	0.026	0.015	$0.57	$45,457.36	$7,110.75	$52,568.11	$992	$1,592	2.54	165%
Circle	WERF Level 0--Lagoon.	0.16	0.065	$3.49	$279,737.60	$30,813.25	$310,550.85	$1,327	$1,587	5.47	511%

NOTE: Operation costs include energy and chemical costs only and do not include labor and maintenance cos

NOTE: The numbers are intended to provide ROUGH ESTIMATES for discussion purposes and

NOTE: Capital costs were assumed to cover a 20-year bond with 5% interest (used 0.0802 conversion factor)

NOTE: MHI is based on data from Montana CEIC based on 2010 estimates.

Table A-3. WERF Cost numbers

WERF

Level	Description	Capital Cost ($/gpd)	Operations ($1/ MG/day Treated)
Level 1	No N and P removal	9.3	250
Level 2	1 mg/l TP; 8 mg/l TN	12.7	350
Level 3	0.1-0.3 mg/l TP; 4-8 mg/l TN	14.4	640
Level 4	<0.1 mg/l TP; 3 mg/l TN	15.3	880
Level 5	<0.01 mg/l TP; 1 mg/l TN	21.8	1370

Table A-4. WERF Cost calculations for Sample

Costs to Meet Criteria	Capital Cost($million/MGD)	Design Flow	Facility Upgrade Capital Costs ($million)	Annualized Capital Costs (Assumed 20-yr bond & 5% interest; $million/year)	Annualized Capital Costs (Assumed 20-yr bond & 5% interest; $/year)	Operations ($1/ MG/day Treated)	Operations Costs ($/ year/ 1 MGD)	Actual Flow	Facility Upgrade Operations Costs (annual) based on Facility MGD	Membrane Replacement Cost ($24,000 /yr/1 MGD)*Actual Flow	Total Operations costs including membrane replacement
Kalispell	9.1	5.4	$49.14	$3.94	$3,941,028.00	1020	372,300.00	3.10	1,154,130.00	74,400.00	1,228,530.00
Bozeman	9.1	13.8	$125.58	$10.07	$10,071,516.00	1020	372,300.00	5.80	2,159,340.00	139,200.00	2,298,540.00
Helena	12.5	5.4	$67.50	$5.41	$5,413,500.00	1120	408,800.00	3.00	1,226,400.00	72,000.00	1,298,400.00
Butte	7.4	8.5	$62.90	$5.04	$5,044,580.00	730	266,450.00	4.00	1,065,800.00	96,000.00	1,161,800.00
Billings	12.5	25	$312.50	$25.06	$25,062,500.00	1120	408,800.00	26.00	10,628,800.00	624,000.00	11,252,800.00
Missoula	7.4	12	$88.80	7.12176	$7,121,760.00	730	266,450.00	9.00	2,398,050.00	216,000.00	2,614,050.00
Great Falls	12.5	25	$312.50	25.0625	$25,062,500.00	1120	408,800.00	26	10,628,800.00	624,000.00	$11,252,800.00
Livingston	12.5	5	$62.50	$5.01	$5,012,500.00	1120	408,800.00	2.00	817,600.00	48,000.00	$865,600.00
Miles City	12.5	3.7	$46.25	$3.71	$3,709,250.00	1120	408,800.00	2.00	817,600.00	48,000.00	$865,600.00
Hamilton	12.5	1.98	$24.75	1.98495	$1,984,950.00	1120	408,800.00	0.68	277,984.00	24,000.00	301,984.00
Lewistown	7.4	2.5	$18.50	1.4837	$1,483,700.00	730	266,450.00	1.50	399,675.00	24,000.00	423,675.00
Havre	12.5	1.8	$22.50	1.8045	$1,804,500.00	1120	408,800.00	1.38	564,144.00	33,120.00	$597,264.00
Columbia Falls	7.4	0.766	$5.67	0.45460568	$454,605.68	730	266,450.00	2.00	532,900.00	48,000.00	$580,900.00
Manhattan	9.1	0.6	$5.46	0.437892	$437,892.00	1020	372,300.00	0.16	59,568.00	3,840.00	$63,408.00
Lolo	12.5	0.34	$4.25	0.34085	$340,850.00	1120	408,800.00	0.38	155,344.00	9,120.00	$164,464.00
Stephensville	12.5	0.3	$3.75	0.30075	$300,750.00	1120	408,800.00	0.29	118,552.00	6,960.00	$125,512.00
Philipsburg	21.8	0.2	$4.36	$0.35	$349,672.00	1370	450,050.00	0.20	90,010.00	4,800.00	$94,810.00
Cut Bank	21.8	0.643	$14.02	$1.12	$1,124,195.48	1120	358,800.00	0.64	230,708.40	15,432.00	$246,140.40
Deer Lodge	21.8	3.3	$71.94	$5.77	$5,769,588.00	1370	450,050.00	1.06	477,053.00	25,440.00	$502,493.00
Glendive	21.8	1.3	$28.34	2.272868	$2,272,868.00	1370	450,050.00	0.6	270,030.00	14,400.00	$284,430.00
Red Lodge	21.8	1.2	$26.16	2.098032	$2,098,032.00	1370	450,050.00	0.65	292,532.50	15,600.00	$308,132.50
Big Fork	21.8	0.5	$10.90	0.87418	$874,180.00	1370	450,050.00	0.30	135,015.00	7,200.00	$142,215.00
Highwood	21.8	0.026	$0.57	0.04545736	$45,457.36	1370	450,050.00	0.015	6,750.75	360.00	$7,110.75
Circle	21.8	0.16	$3.49	0.2797376	$279,737.60	1370	450,050.00	0.065	29,253.25	1,560.00	$30,813.25

APPENDIX B - ASSUMPTIONS IN THE COST ANALYSIS

DESCRIPTION OF THE ASSUMPTIONS/ DETAILS IN THE SPREADSHEET

- The spreadsheet numbers are intended to provide ROUGH ESTIMATES for discussion purposes and do not reflect the site-specific conditions at each plant.
- The cost estimates for upgrading WWTPs are obtained from the Interim WERF study: "Finding the Balance Between Wastewater Treatment Nutrient Removal and Sustainability, Considering Capital and Operating Costs, Energy, Air and Water Quality and More" (Draft 2010). This report is in Draft form and the capital costs are anticipated to increase in the final report based on feedback from the technical reviewers. Based on actual costs observed in Region 1, Region 1 considered the capital costs to be higher than experienced in the final facility plan.
- The total number of WWTPs in Montana that would have to meet base nutrient criteria would be 107. 83 of these are lagoons, and most of these lagoons are small (< 1 MGD).

- Larger, advance WWTPs in Montana would have an easier time meeting nutrient criteria than other WWTPs. In fact, all lagoon systems would face financial hardship meeting the base criteria (> 2% MHI). Therefore, the sample in this analysis focused on the 7 largest communities in MT, 7 medium sized communities with advanced wastewater treatment, 4 smaller communities with advanced treatment < 1MGD, and 8 smaller communities with lagoons.
- Reverse osmosis is assumed to be the technology that would allow WWTPs to have the best chance at meeting base numeric criteria. It is ultimately assumed that 100% of wastewater would need to go through the reverse osmosis process to reach Montana standards.
- The design flows of new RO plants would be the same as current plants, unless otherwise noted. This is a conservative assumption.
- Current sewer rates per household were obtained from direct calls to the municipalities to obtain sewer rate information. Paul LaVigne at DEQ was instrumental in collecting many of these numbers.
- Annual costs of both capital and operations estimates were used in the spreadsheet to calculate the increase in sewer rates and percent MHI.
- Capital costs were assumed to cover a 20-year bond with 5% interest (used a conversion factor of 0.0802). An alternate assumption used a 7% interest rate.
- Level 1 in the Interim WERF Study reflected secondary treatment, which is more advanced treatment than a lagoon system because it assumes a mechanical plant. For lagoons, the total cost of getting to WERF Level 5 (which uses RO) was used and was calculated on a pro-rated basis (per flow), minus the current O&M costs for a lagoon. Current O&M costs for a facultative lagoon are assumed to be $50,000 annually for all FLs and $150,000 for an Aerated Lagoon.
- WERF level 5 is not quite as stringent as the Montana base nutrient criteria for TN, so the costs to reach nutrient standards in Montana are underestimated. An alternate assumption addresses this issue.
- For the Montana towns in this analysis with advanced treatment, the cost associated with the WERF level they are currently at is subtracted from WERF level 5 costs in the study. That means that all WWTPs in our sample already at WERF level 2 will have the same estimated unit capital and O&M costs to meet base numeric criteria. Estimate total costs will differ based on facility flow.
- Operation costs in the WERF study, and therefore in this analysis, include energy and chemical

costs only and do not include labor and maintenance cost. As such, the O&M cost numbers in this analysis are on the low side. An alternate assumption addresses this issue by adding labor costs.

- The costs in this demonstration do not include lagoon abandonment, so they may underestimate total costs.
- Capital and O&M costs for lagoons to get up to WERF 5 are based on building from scratch, assuming that no infrastructure exists. This assumption is valid, because for lagoon systems converting to RO, it would be the same as a greenfield project, since a lagoon would have to do a complete rebuild. In addition, a lagoon would have to be decommissioned and abandoned which could be expensive (abandonment costs are not included in this analysis_.
- To get to RO, a membrane Replacement Cost is added which is estimated at $24,000 /yr/1 MGD. Brine disposal costs are included within the WERF numbers.
- Design flow of a given WWTP was used to determine the capital costs and actual flow was used for the Operations costs. Flows for towns were taken from wastewater permits.
- A community's population was estimated from Census 2010. The number of households in a community was estimated from the American Community Survey 5-year estimate 2005-2009. The number of households was used as a proxy for the number of hookups per WWTP, as that number was often hard to obtain from operators.
- A threshold total cost per household of 2% of a town's median household income (MHI) includes: 1) current wastewater fees plus 2) additional wastewater fees to meet base criteria. Greater than 2% MHI of these two costs is considered a significant cost per the Guidance. A town then moves on to the second 'Significant Test' of secondary economic indicators. Because 104 out of 107 towns would experience costs of greater than 2% (MHI), and because current rates average just under 0.9% MHI, the average wastewater rate in Montana in affect towns would more than double to meet standards.

APPENDIX C - SECONDARY INDICATORS

Table C-1 Secondary Indicators for the Municipality.
Example of Town X: Poverty rate 20%, LMI 47%, Unemployment rate 7.1%, MHI $39,201, Property Tax index number 1.21%.

	Secondary Indicators			
Indicator	**Weak***	**Mid-Range****	**Strong*****	**Score**
Poverty Rate	More than 16%	4-16%	Less than 4%	1
Low to Medium Income Percentage (LMI)	More than 51%	23-51%	Less than 23%	2
Unemployment	More than 1% above State Average (>8.2%)	State Average 2009----7.2%	More than 1% below State Average (<6.2%)	2
Median Household Income	More than 10% below State Median	State Median $42,322 (2009)	More than 10% above State Median	2
Property Tax, fees and revenues divided by MHI and indexed by population	More than 3.0	3.0 to 1.5	Less than 1.5	3
* Weak is a score of 1 point				
** Mid-Range is a score of 2 points				
*** Strong is a score of 3 points			**SUM:**	10
			AVERAGE:	2.00

There are five socioeconomic criteria that are summed up and averaged to see where the households within a community fall in terms of financial health. For each of the five criteria, a strong score is recorded in the right hand column as a '3', indicating strong socioeconomic health for that criteria and thus a greater chance of being able to pay for additional wastewater treatment (and lesser chance of a variance). A mid-range score is recorded as a '2' and indicates moderate or average socioeconomic health for the particular criteria. A weak score should be recorded as a '1' and indicates poor socioeconomic health for the given criteria or less ability to pay (and a greater chance of being granted a variance). The average score of all five indicators falls into those same categories and should be judged in the same way.

For poverty rate and LMI, the strong, mid-range and weak score are derived by taking averages of each of these five indicators for a sample of 41 selected towns and then running a histogram. The histogram using the latest data gives us breaks for strong, mid-range, and weak scores using best professional judgment. The same method is used for Property tax, fees, etc. except that a sample of 49 towns was used to create the histogram, due to the large data requirements and that we had to calculate this figure ourselves. For unemployment and MHI, towns are compared to the state average.

The last criteria, Property tax, fees and revenues divided by MHI and population, gives an indication of the existing burden on local residents within the municipality of fees for local services and of local taxes. Those citizens of towns already paying a lot of money relatively for services such as wastewater and garbage and/or paying higher local taxes are assumed to be less able to pay additional monies for additional wastewater treatment since they already have a formidable local tax burden.

Specific assumptions for the Secondary test include:

- Population estimates were compiled by the Montana CEIC and are based upon Census 2010. Median household income and number of households per community were compiled from the Montana CEIC and are based on the American Community Survey 5-Year Estimate (2005-2009)
- Local area taxes, revenues and property taxes are from Fiscal year ending June 30, 2010. This information is from the Local government Services Bureau, Montana Department of Administration, Kim Smith, (406) 841-2905, kims@mt.gov. There is not tax data Big Fork and Highwood because they are not incorporated, and thus not required to report this data. Broadus and Columbia Falls gave unaudited financial statements in FY2010 and are 'audit report delinquent', but the numbers were used anyway. Ekalaka, Froid, Fromberg, Hamilton, Ismay, Lima and Sidney's FY 2010 reports are unaudited. Deer Lodge data from FY 2008 due to no recent reporting. For those towns for whom this tax data does not exist, their average secondary score was based on four economic metrics rather than five.
- To calculate the Local area taxes, revenues and property tax index, the following three items from each town are summed up: 1) General Government Activities (Charges for Services, Fines, Forfeitures, including public works, safety, interest on debt and health), 2) Business Type Activities (Hospital, water, sewer, solid waste, airport, business), 3) Local property taxes. The sum of these three items is then divided by that town's MHI. The town's population is divided by 50,000 to index it—create a population index. The sum of the three items divided by MHI is divided by the population index to come up with the Local area taxes, revenues and property tax index. The index numbers were taken for all towns in this study and a histogram was run in Excel to determine cutoff points for a weak score (the town already has a lot of local taxes to pay compared to other towns which translates to a high index number—greater than 3.0 index score), a mid-range score, or a strong score (the town currently has a low amount of local taxes/fees to pay compared to other towns which translates to a low index number—less than 1.5 index score)
- Unemployment rates are from July of 2011 from Aaron McNay, Economist, Montana Department of Labor and Industry, 406-444-3245. They only have unemployment estimates for cities that have a population that is 25,000 or larger. For all the other cities, we can only provide county level estimates for the county they are in. Butte and Silver Bow county are considered one entity, so the county number was reported. Only Billings, Bozeman, Helena, Missoula and Great Falls have actual unemployment rate estimates for the city.
- Low and Moderate Income Percent was calculated using a proxy for the HUD definition of LMI. Low and Moderate Income Percent is calculated by U.S. Housing and Urban Development (HUD) using data from the U.S. Census Bureau's Decennial Census, specifically for the Community Development Block Grant Program (CDBG). LMI families are defined as those families whose income does not exceed 80% of the county median income for the previous year or 80% of the median income of the entire non-metropolitan area of the State of Montana, whichever is higher. (U.S. Census Bureau, Census 2000, Decennial Census of Population and Housing, Summary File (SF) 1 and Summary File (SF) 3 ; and U.S. Department of Housing and Urban Development (HUD), Community Planning and Development). It is this method that was used to calculate Montana's 2000 LMI numbers. HUD did not update their figures from 2000, so DEQ had to calculate it own version of LMI.
- LMI for 2011 was calculated by DEQ by taking the number of persons who live below 200% of the poverty level threshold for a town, and dividing by the total number of persons in a town. The data used was the 2005-2009 American Community Survey 5-Year Estimates. The resulting numbers are similar to 2000 numbers using the HUD definition because 200% poverty level is close to 80% of Montana's median family income (MFI), which is close to the 2000 HUD

definition for LMI. A histogram was used to create break points for strong, medium, and weak LMI scores.

- The source for poverty rate is the 2009 American Community Survey Data and the Social Explorer website. (http://www.socialexplorer.com/pub/reportdata/metabrowser.aspx?survey=ACS2009_5yr&ds=Social+Explorer+Tables%3A++ACS+2005+to+2009+(5-Year+Estimates)&table=T118&header=True) To determine a person's poverty status, one compares the person's total family income in the last 12 months with the poverty threshold appropriate for that person's family size and composition. If the total income of that person's family is less than the threshold appropriate for that family, then the person is considered "below the poverty level," together with every member of his or her family. If a person is not living with anyone related by birth, marriage, or adoption, then the person's own income is compared with his or her poverty threshold. The total number of people "below the poverty level" is the sum of people in families and the number of unrelated individuals with incomes in the last 12 months below the poverty threshold. The official poverty thresholds do not vary geographically, but they are updated for inflation using Consumer Price Index (CPI-U). The official poverty definition uses money income before taxes and does not include capital gains or noncash benefits (such as public housing, Medicaid, and food stamps). (http://www.census.gov/hhes/www/poverty/methods/measure.html). A histogram was used to create break point for strong, medium and weak LMI scores.

Table C-2. Secondary Score Case Studies--Public WWTPs

	Poverty Rate % (2009)	LMI % (2009)	Unemployment Rate % (July 2011)	MHI (estimated 2009 dollars)	Total Revenues, Fees and Taxes index
Baker	8.18	27.9	2.7	47,305	1.80
Big Fork	2.19	16.0	10.4	44,398	N/A
Billings	8.49	31.4	5.5	45,004	2.31
Bozeman	10.68	39.8	6	41,661	2.66
Butte	10.51	38	6.7	37,255	1.42
Broadus	0	24	5.3	45,938	3.71
Circle	3.97	54.4	2.9	29,000	2.88
Columbia Falls	6.38	42.8	10.4	38,750	1.94
Cut Bank	17.92	35.9	11.7	44,833	2.12
Deer Lodge	8.67	35.4	8.9	40,320	1.14
Ekalaka	9.48	34.1	3.9	32,917	3.02
Ennis	6.44	46.0	7.2	37,639	2.64
Eureka	12.85	61.4	14.6	37,813	1.96
Froid	8.16	26.9	9	24,706	3.50
Fromberg	6.18	26.0	6.2	42,011	1.34
Glendive	7.34	24.4	4.4	42,821	1.99
Great Falls	11.85	34.1	6.9	40,718	2.63
Hamilton	19.47	46.8	9.9	25,161	3.45
Havre	9.41	36.5	6.5	43,577	1.73
Helena	5.96	28.5	5.5	47,152	2.60

Highwood	0	7.50	5	62,614	N/A
Ismay	0	0.0	4.7	32,083	0.41
Kalispell	14.2	40.4	10.4	39,953	2.43
Lewistown	13.6	47.4	5.8	31,729	2.72
Libby	10.14	51.0	14.6	27,267	3.21
Lima	11.11	66.5	5.9	27,875	1.90
Livingston	8.08	34.0	7	35,689	3.31
Lolo	9.5	33.6	7.4	46,422	N/A
Manhattan	5.22	30.7	6.3	50,729	1.56
Miles City	11.5	38.1	4.7	37,554	2.17
Missoula	11.15	44.8	6.9	34,319	1.79
Neihart	9.52	12.1	5.6	42,312	3.32
Phillipsburg	10.57	48.7	10.1	31,375	2.26
Plentywood	1.57	34	3.8	36,632	1.70
Red Lodge	6.28	34.7	6.2	50,123	2.90
Roundup	17.27	51.4	6.9	33,750	1.75
Shelby	5.25	35.4	5.2	40,552	2.60
Sidney	23.76	38.6	3.5	49,784	0.74
St. Ignatius	29.63	56.6	10.9	28,542	1.62
Stevensville	20.19	56.1	9.9	33,776	1.72
West Yellowstone	14.35	38.5	6.3	39,231	3.06

Table C-3. Secondary Score Case Studies--Public WWTPs Actual Secondary Scores

	Poverty Rate Secondary Score	LMI Secondary Score	Unemployment Rate Secondary Score	MHI (estimated 2008 number) Secondary Score	Total Revenues, Fees and Taxes index Secondary Score	Average
Baker	2	2	3	3	2	2.4
Big Fork	3	3	1	2	N/A	2.25
Billings	2	2	3	2	2	2.2
Bozeman	2	2	3	2	2	2.2
Butte	2	2	2	1	3	2
Broadus	3	2	3	2	1	2.2
Circle	3	1	3	1	2	2
Columbia Falls	2	2	1	2	2	1.8
Cut Bank	1	2	1	2	2	1.6
Deer Lodge	2	2	1	2	3	2
Ekalaka	2	2	3	1	1	1.8
Ennis	2	2	2	1	2	1.8
Eureka	2	1	1	1	2	1.4
Froid	2	2	1	1	1	1.4
Fromberg	2	2	2	2	3	2.2
Glendive	2	2	3	2	2	2.2

Great Falls	2	2	2	2	2	2
Hamilton	1	2	1	1	1	1.2
Havre	2	2	2	2	2	2
Helena	2	2	3	3	2	2.4
Highwood	3	3	3	3	n/a	3
Ismay	3	3	3	1	3	2.6
Kalispell	2	2	1	2	2	1.8
Lewistown	2	2	3	1	2	2
Libby	2	2	1	1	1	1.4
Lima	2	1	3	1	2	1.8
Livingston	2	2	2	1	1	1.6
Lolo	2	2	2	2	n/a	2
Manhattan	2	2	2	3	2	2.2
Miles City	2	2	3	1	2	2
Missoula	2	2	2	1	2	1.8
Neihart	2	3	3	2	1	2.2
Phillipsburg	2	2	1	1	2	1.6
Plentywood	3	2	3	1	2	2.2
Red Lodge	2	2	2	3	2	2.2
Roundup	1	1	2	1	2	1.4
Shelby	2	2	3	2	2	2.2
Sidney	1	2	3	3	3	2.4
St. Ignatius	1	1	1	1	2	1.2
Stevensville	1	3	1	1	2	1.6
West Yellowstone	2	2	2	2	1	1.8